EDUMASPUL
JURNAL PENDIDIKAN
Vol. 6 – No. 2, year (2022), page 3079-3086
| ISSN 2548-8201 (Print) | 2580-0469) (Online) |

Development of Hologram-Based Learning Media for Class VII Science Subjects at SMP Negeri 53 Makassar

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Receive: 14/07/2022	***Accepted: 19/08/2022***	***Published: 01/10/2022***

ABSTRACT

This study aims to (a) find out the results of the feasibility test of hologram-based learning media in science subjects class VII SMP Negeri 53 Makassar, (b) find out the results of users' responses to hologram-based learning media in science subjects class VII SMP Negeri 53 Makassar, (c) find out the results of the effectiveness and practicality of hologram-based learning media in class VII Science subjects at SMP Negeri 53 Makassar. This research is research and development (Research and Development) with the ADDIE development model consisting of analysis, design, development, implementation, and evaluation. Based on the results of the research, the feasibility test of hologram-based learning media is based on the assessment of media experts in the very feasible category and the material expert's assessment in the very feasible category, so that this media meets the very feasible category to be used as a learning medium. The responses of class VII students of SMP Negeri 53 Makassar as media users based on the results of the small group trials and the results of the large group trials were in very good categories, so that the media was feasible to be used as learning media in the learning process. And the developed hologram-based learning media meets effective and practical aspects. It is known that based on the average score and classical completeness posttest higher than the average score and classical completeness pretest, so that the developed media is effective. Meanwhile, based on small group trials and large group trials, the media received a positive response in the "Very Good" category, so that it can be said that the developed media provides useful value and convenience for users, in other words, hologram-based media is practical to use.

Keywords : *Learning Media, Hologram, ADDIE*

INTRODUCTION

Technological developments in the current era have penetrated into everyday life. The use of technology is part of all sectors in the fields of education, transportation, health, economy, politics, and so on. From the education sector, technology has been very helpful in the past few years in the learning process that still applies conventional learning.

Learning media as something that can be used to provide stimulation so that teaching and learning interactions occur in order to achieve certain learning goals, starting from the simplest and easiest to use, namely, the teacher's voice to those which are very complex equipment such as videos, tape recorders, and so on. According to Yusufhadi Miarso in Nurrita, T. (2018) learning media is anything that is used to convey messages and can stimulate the thoughts, feelings, concerns, and willingness of the student so that it can encourage a deliberate, purposeful, and controlled learning process.

The teaching and learning process at SMP Negeri 53 Makassar in science subjects is still abstract because some of the learning media used are still one-way. Whereas in science subjects there is a lot of material that requires a type of visual motion learning media in the learning process. This makes the students at SMP Negeri 53 Makassar, especially in class VII, tend to feel bored following the teaching and learning process which uses makeshift media. This was known after the researchers directly observed the learning process taking place and conducted interviews on Monday, May 3 2021 with one of the teachers named MH. Afdal Hamid, S.Pd. at SMP Negeri 53 Makassar.

Several studies on the use of 3D holograms as learning media have been carried out. Safitri and Djuniadi (2021) in their research have produced 3D hologram-based learning media in learning Coconut Plants. Based on the trials, the students' pre-test score was 75 and the post-test score was 99.3, indicating that students' ability to understand material about the parts and benefits of the coconut plant has increased. From the N-Gain calculation, it can be said that the media is effective in increasing student learning outcomes. Thus, the developed 3D hologram-based coconut plant learning media is feasible, effective, easy and useful for students, teachers, and parents in Al Madina Islamic Kindergarten, Semarang City. Another study conducted by Orcos, Jordán, and Magreñán (2019) entitled "3D Visualization through the Hologram for the Learning of Area and Volume Concepts". Producing 3D hologram media for learning volume and geometrical area for grade 3 elementary school children. Based on the analysis of the results of the pre-test and post-test, the learning outcomes of students who used this media were higher than students who studied traditionally. Another research conducted by Kurniawan, Susilaningsih and Soepriyanto (2019) with the title "Development of 3 Dimensional Digital Vacuum Circuit Breaker Object Media Using Holographic Pyramids". Based on student responses regarding digital 3-dimensional object media utilizing this holographic pyramid, cadets feel interested and motivated to learn when using this media.

Based on these studies and the results of the needs analysis at SMP Negeri 53 Makassar, researchers want to develop hologram-based learning media for science subjects class VII SMP Negeri 53 Makassar.

THEORITICAL REVIEW

Broadly speaking, Bretz and Schmidbauer in Anggiani (2020) classify media into three elements, namely sound, visual, and motion. Two of them, visual and motion, can be created using graphic design and projected in the form of a hologram. Holograms are products of holographic technology. 3D hologram media is one of the newest innovations developed in the world of education.

The advantage of a hologram is that it is able to store information, which contains 3-dimensional (3D) objects, 3D display is something new for students so that it can attract students' interest in participating in learning, holograms can also be used by more than one person , another advantage of holograms compared to image media is the lower level of radiation because students do not look directly at the cellphone screen but from the holographic reflection media. (Ridsa et al., 2020).

Five very important components in the teaching and learning process according to Oemar Hamalik in Falahuddin (2014) are objectives, materials, methods, media, and learning evaluation. These five aspects influence each other. The choice of one particular

teaching method will have an impact on the appropriate type of learning media, without forgetting three other important aspects, namely objectives, materials, and learning evaluation. In this case, it can be said that one of the main functions of learning media is as a teaching aid which also influences learning outcomes, conditions, and the learning environment.

Learning outcomes are outputs that are produced after students participate in learning activities. One's learning outcomes are determined by various factors that influence it. One of the factors that exist outside the individual is the availability of learning media that makes it easy for individuals to study learning material, resulting in better learning outcomes.

RESEARCH METHODS

The type of research used is R&D with the ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation. The subjects in this study consisted of 2 lecturers as instrument experts, 2 teachers as material experts, namely teaching staff at SMP Negeri 53 Makassar, 2 lecturers as media experts. Then the media was tested on students with a development test phase consisting of 6 students in small group trials and 32 class VII students from SMP Negeri 53 Makassar as respondents in the trial phase. use of hologram-based learning media.

Figure 1 ADDIE development model steps

In the analysis process (analysis) carried out work analysis and needs analysis by determining the current conditions. The analysis in this study was obtained through direct interviews with teachers. From the interview results, it was obtained that a learning media was needed to support Home Learning (BDR) during this pandemic, which means that learning media can be u

at home.

At the design stage, what is done is: (1) preparing material, (2) making flowcharts, (3) collecting teaching materials in the form of images, videos, animations and so on, (4) designing hologram videos, and (5) compiling reference tests (pre-test and post-test).

The following is a flowchart of hologram-based learning media applications:

Gambar 2 *Flowchart* Aplikasi BioHolo

The development stage was carried out: (1) making several holographic videos according to the material and materials that had been prepared. After that the researcher made an android application according to the design in the previous stage. (2) Create product validity questionnaires for media experts and material experts, questionnaires for teacher and student responses. (3) validation of hologram-based learning media carried out by media experts and material experts.

The implementation stage is carried out by validating instruments, media and materials. Then repair the media according to the suggestions of the material and media validator, then the media is tested on class VII students of SMPN 53 Makassar with a development test phase consisting of small group trials and large group trials.

The evaluation phase is carried out by analyzing the media at the implementation stage whether there are still deficiencies and weaknesses or not. If there are no more revisions, then the media is suitable for use.

Data collection techniques used in this study were interviews and documentation. While the data collection instruments were in the form of: pre-test and post-test questions, a feasibility questionnaire for media experts and material experts.

Research data were analyzed qualitatively and quantitatively. Qualitative data were obtained from criticism, comments or suggestions to improve the quality of the media, while quantitative data were obtained from questionnaire assessments using a Likert calculation scale. Each answer given is associated with a statement expressed in words such as Strongly Agree (SS), Agree (S), Undecided (RG), Disagree (TS) or Strongly Disagree (STS). Each of these supporting statements is given points 5 – 1 with the details of the points as follows.

Table 1. Details of the Likert Scale Assessment

Statement	score
Strongly agree	5
Agree	4
Doubtful	3
Don't agree	2
Strongly Disagree	1

The scores obtained from each respondent are then averaged using the following formula.

$$\bar{x} = \frac{\sum x}{n}$$

Keterangan:

$\bar{x}$: Respondent's overall average score

x: Total score of each respondent

n: Number of respondents

Once the average score is known, it is then calculated using the percentage formula to determine the presentation validity or eligibility of the media which can be seen as follows.

$$\text{Presentase} = \frac{\text{score average}}{\text{score maksimum total}} \times 100\%$$

The results of the presentation are then concluded based on the criteria. The analysis criteria for the validity level of the research instrument can be seen in the following table.

Table 2. Instrument Validity Level Analysis Criteria

Interval	Evaluation
81% - 100%	Very good
61% - 80%	Well
41% - 60%	Currently
21% - 40%	Not good
< 20%	Very Not Good

The analysis criteria for the feasibility level of the media are reviewed from the results of the scores from media experts and material experts which can be seen in the following table.

Table 3. Criteria for Analysis of the Eligibility Level of Media Experts

Interval	Evaluation
81% - 100%	Very good
61% - 80%	Well
41% - 60%	Currently
21% - 40%	Not good
< 20%	Very Not Good

The criteria for analyzing user responses related to the media that have been developed in terms of the score results by the respondents can be seen in the following table.

Table 4. Criteria for Analysis of Media User Responses by Respondents

Interval	Evaluation
81% - 100%	Very good
61% - 80%	Well
41% - 60%	Currently
21% - 40%	Not good
< 20%	Very Not Good

Hologram-based learning media is said to improve learning outcomes if it meets the indicators, the average student learning outcomes test score meets classical completeness, namely 75% of all students score greater than or equal to the Maximum Completeness Criteria (KKM). Individual completeness can be achieved if the learning outcomes of students reach ≥ 75 out of a maximum score of 100, while classical completeness can be achieved if 75% of the number of students in the class have achieved a score of ≥ 75. The calculation used to obtain the classical

completeness of students who complete using the following classical mastery formula

$$KK\ (\%)\ = \frac{\sum ST}{\text{n}} \times 100\%$$

The percentage of completeness with the interval criteria for mastery of the student learning outcomes test is as follows:

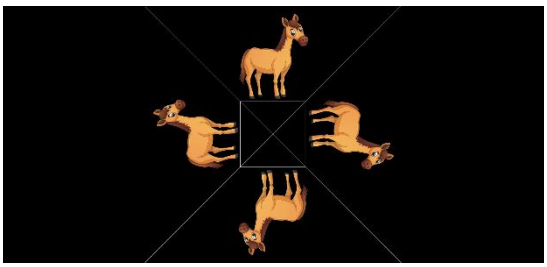
Table 5. Criteria for the completeness of student learning tests

Interval	Evaluation
81% - 100%	Very good
61% - 80%	Well
41% - 60%	Currently
21% - 40%	Not good
< 20%	Very Not Good

Based on the table above, hologram-based learning media is said to be effective if the completeness of the student's learning achievement test meets the minimum good criteria.

RESULTS AND DISCUSSION

The results of this research product are hologram-based learning media which consists of two parts, namely (1) an android application called BioHolo (Hologram Biology) which contains instructions, materials (hologram videos), quizzes and information; and (2) holographic pyramid made of mica plastic.

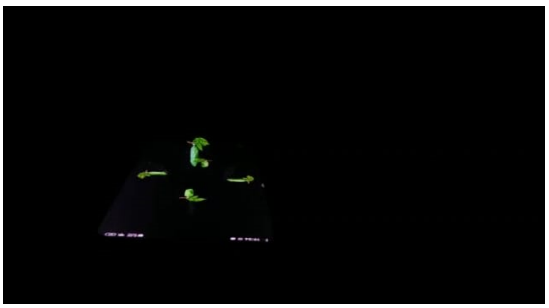


Gambar 3. View of the BioHolo Application

The material presented in the BioHolo application is guided by the syllabus and semester one lesson plan for science class VII SMPN 53 Makassar. The Bioholo application was developed using Smart Apps Creator, Figma, Adobe After Effects, and Wondershare Filmora X software. The sites/websites as references for researchers to obtain holographic video objects, namely, www.freepik.com and open3dmodel.com.

This application acts as an intermediary or a place where the hologram video is stored. This application has several menus, namely: (1) the instructions menu contains instructions for use and instructions for making holographic pyramids made of mica plastic, (2) the material menu contains 3 sub-materials presented, there is an explanation of each sub-material and as well as the learning objectives, besides that there is a hologram video play button which will display a 4-sided hologram video, (3) the quiz menu contains 10 numbers related to 3 sub-materials, each point number is 10, (4) the information menu contains profile information developers and there are also the logos of 2 educational institutions namely UNM and SMPN 53 Makassar. The following shows the application, a 4-sided hologram video and a hologram video object using a holographic pyramid.

Gambar 4. Tampilan Video Hologram 4 Sisi



Gambar 5. Tampilan Video Hologram

Presentation of Validation Results Data is carried out by material experts and media experts. Data collection was carried out after the media received a valid/proper assessment from instrument experts, media experts, and material experts. Instrument experts consisted of two validators, media experts consisted of two validators who were lecturers at the Faculty of Engineering, Makassar State University and material experts consisted of two validators who were science teachers at SMP Negeri 53 Makassar.

Media expert validation data can be obtained from the results of filling out the questionnaire to media experts. To carry out media validation, it consists of 16 questions, comments and suggestions obtained from media experts used as a basis for revising before being tested on students. The average results of the media expert's assessment of the hologram-based learning media that have been developed can be seen in table 6.

Table 6. Average Results of Media Expert Assessments

No	Evaluator	Total Score	Maks. Score	Presentse	Kategori
1	Validator 1	75	80	93.75%	Very Worth it
2	Validator 2	78	80	97.5%	Very Worth it
average		76.5	80	95.62%	Very Worth it

Source: Processed research data

Based on the recapitulation in Table 6 of the media expert's assessment, the learning media received positive responses from the validator with the total number of answers in all the items specified. Then the overall quality of the assessment can be calculated in the form of a percentage with a result of 95.62% with a very decent category. So it can be concluded that the media is feasible to use as a learning medium. This eligibility is a form of media that is truly declared worthy of media experts and can be continued to users or students to be tested.

Material expert validation data can be obtained from the results of filling out a questionnaire to material experts. Material expert validation was carried out by two validators. The instrument for validating this material consists of 14 questions. Comments and suggestions obtained in the validation of material experts are used as a basis for revising before learning media is tested on students. The average results of the material expert's assessment of the learning media developed are shown in Table 7.

Table 7. Average Material Expert Assessment

No	Evaluator	Total Score	Maks. Score	Presentse	Kategori
1	Validator 1	75	80	93.75%	Very Worth it
2	Validator 2	78	80	97.5%	Very Worth it
Average		76.5	80	95.62%	Sangat Layak

Source: Processed research data

Based on the recapitulation of the assessment of the material expert validation test results, a positive response was received from the validator with the total number of answers in all specified items. Then the overall quality of the assessment can be calculated in the form of a percentage with a result of 97.14% in the very decent category. So it can be concluded that the media is suitable for testing.

In the previous stage, the developed hologram-based learning media received suggestions and input so as to produce media that was feasible to be tested on class VII students of SMP Negeri 53 Makassar. In this trial carried out with small scale trials and large scale trials.

Small-scale trials were conducted to obtain limited empirical data regarding responses to media. This small group trial involved 6 class VII students of SMP Negeri 53 Makassar. The questionnaire distributed to students consisted of 15 questions. Data obtained from students is used to determine responses to the use of Hologram-based learning media.

Table 8. Data on the Percentage of Small Group Trial Assessment Results

No.	Aspect	Total Score	Maks. Score	Persentase	Kategori
1	Material Quality	117	120	97.5%	Very good
2	Application View	107	120	89.17%	Very good
3	Hologram Videos	87	90	96.67%	Very good
4	Benefit	114	120	95%	Very good
Total		425	450	94.44%	Sangat Baik

Source: Processed research data

Based on the overall summary of the results of the small group trials, the media received a positive response with a total score of 425 out of 450 maximum scores and a percentage of 94.44% in the "Very Good" category. So that it can be said that the developed media provides useful value and convenience for users, in other words, hologram-based media is practical to use.

Large-scale trials were carried out to obtain empirical data regarding user responses to hologram-based learning media in general. This large group trial involved 32 class VII students of SMP Negeri 53 Makassar. The questionnaire

distributed to students consisted of 15 questions. Data obtained from students is used to determine responses to the use of Hologram-based learning media.

Table 9. Data on the Percentage of Results of the Large Group Trial Assessment

No.	Aspect	Total Score	Maks. Score	Persentase	Kategori
1	Material Quality	587	640	91.71%	Very good
2	Application View	567	640	88.59%	Very good
3	Hologram Videos	430	480	89.58%	Very good
4	Benefit	581	640	90.78%	Very good
Total		2165	2400	90.20%	Very good

Source: Processed research data

Based on the overall summary of the results of the large group trials, the media received a positive response with a total score of 2165 out of 2400 maximum scores and a percentage of 90.20% in the "Very Good" category. So that it can be said that the developed media provides useful value and convenience for users, in other words, hologram-based media is practical to use.

Hologram-based learning media can be declared effective, this is reviewed based on student learning outcomes. Based on the results of research conducted by researchers, it was found that the hologram-based learning media used can have a very good effect on students. At the time of giving the pretest before using hologram-based learning media with a total of 10 numbers of questions, of 32 students the highest score was 80, while the lowest score was 20. The average student score was at 50.62% with the number of students who completed 2 participants students and then students' classical completeness at 6.25%.

Then after the hologram-based learning media was used, the results of the study stated that of the 32 students the highest score was 90, the lowest score was 40, the average student score in the posttest was 75.31% with the number of students who completed 25 students, as well as classical completeness students on the posttest 78.12%.

Table 10. Student Learning Outcomes

Test results	Pretest	Posttest
Highest Score	80	90
Lowest Score	20	40
Average	50.62%	75.31%
complete	2	25
Not Completed	30	7
Classical Mastery	6.25%	78.12%

Source: Processed research data

Based on the description above, it can be stated that the mean value and classical completeness posttest are higher than the average value and classical completeness pretest. It can be concluded that the developed hologram-based learning media is effective.

Discussion

In this study, the product produced was a hologram-based learning media for class VII science students at SMP Negeri 53 Makassar. Hologram-based learning media or what can be called BioHolo is a medium that can support the learning process in class VII Science subjects at SMPN 53 Makassar. BioHolo functions as an intermediary or place to store holographic videos. The video discusses some of the material contained in KD 3.2 classifying living things and objects based on the characteristics observed. The learning material is the classification of living things and non-living things, the characteristics of living things, and the introduction of the microscope.

Objects can be seen in 3 dimensions (3D) by using a holographic pyramid. This is based on the understanding of the holographic pyramid that has been stated in Chapter II, the holographic pyramid is a system for creating 3-dimensional (3D) visual object models. The hologram pyramid consists of hardware and software that is arranged to create a holographic image. The Hologram Pyramid is a simple device that can be made by manipulating a sheet of plastic into a pyramid shape with a cut-off top. (Tawaqqal et al., 2017).

The type of research used is Research and Development (R&D) with the ADDIE development model which has five stages of development namely Analysis, Design, Development, Implementation, Evaluation.

The analysis phase is the initial or first stage of the ADDIE model. At this stage an initial analysis, material concept analysis, and content analysis and media needs have been carried out to analyze things that support the development of hologram-based learning media.

The design stage is the second stage of the ADDIE model. This stage provides an initial description of the media to be developed. This stage includes designing instructional media, designing flowcharts, collecting materials, and compiling a grid of feasibility assessment instruments and user responses, so that developers can proceed to the next stage.

The development stage is the third stage of the ADDIE model. At this stage, the development of valid and usable hologram-based learning media is carried out. Starting from making animation/motion and 3D models in Adobe After Effects software, then making holographic videos based on material on basic competency 3.2 science subjects class VII and making 4-sided videos in software called Wondershare Filmora X. After the hologram videos are finished, next create applications using Smart Apps Creator. This application is named BioHolo as an intermediary or place to access the hologram video. Then the learning media was validated by two media experts and

two material experts. Before the media was validated, the instrument sheet/questionnaire was validated first by two instrument expert lecturers.

The fourth stage is the implementation stage. Hologram-based learning media was tested on class VII students at SMP Negeri 53 Makassar. This trial consisted of small group trials and large group trials.

The fifth or final stage is the evaluation stage. This stage includes formative evaluation and summative evaluation. Formative evaluation is carried out to collect data at each stage which is used for improvement and summative evaluation is carried out at the end of the program to determine the effect on student learning outcomes.

The feasibility of hologram-based learning media is assessed by media experts and material experts. Media expert validation was carried out by two JTIK lecturers by filling out media validation sheets. Media experts provide suggestions and responses to the media being developed, namely audio that needs to be improved and these suggestions have been corrected by the developer. Based on the validation results of two media experts, it was obtained an average rating of 97.14% with a very decent category. Assessment on the validation sheet is carried out using a Likert scale.

Material expert validation was carried out by two science subject teachers at SMP Negeri 53 Makassar. Material experts provide suggestions and responses to the media developed, namely in the material there are no learning objectives in each material and these suggestions have been corrected by the developer. Based on the validation results of two material experts, an average rating of 99.09% was obtained with a very decent category. Assessment on the validation sheet is carried out using a Likert scale.

User trials of hologram-based learning media are carried out through trials on a small group and group scale big mom. Trials on a small group scale were carried out by 6 students by filling out a questionnaire. Based on the results of user responses, it was obtained that the percentage was 94.44% in the very good category. The assessment on the user response questionnaire was carried out using a Likert scale, the validation results were calculated using the percentage formula. In the aspect of material quality, the total score for all answers to all items was 117 of 120 maximum scores and a percentage of 92.5% in the "Very Good" category. In the display aspect of the application, the total score of the answers to all questions was 107 of 120 maximum scores and a percentage of 89.17% in the "Very Good" category. In the holographic video aspect, the total score for all answers to all items is 87 out of 90 with a maximum score and a percentage of 96.67% in the "Very Good" category. In the aspect of benefits, the total score for all answers to all items is 114 of 120 maximum scores and a percentage of 95% in the "Very Good" category.

Based on the overall summary of the results of the small group trials, the media received a positive response with a total score of 425 out of 450 maximum scores and a percentage of 94.44% in the "Very Good" category. So that it can be said that the developed media provides useful value and convenience for users, in other words, hologram-based media is practical to use.

Meanwhile, trials on a large group scale were carried out by 32 students by filling out a questionnaire. Based on the results of user responses, it was obtained that the percentage was 90.2% in the very good category. The assessment on the user response questionnaire was carried out using a Likert scale, the validation results were calculated using the percentage formula. In the aspect of material quality, the total score for all answers to all items was 587 of 640 maximum scores and a percentage of 91.71% in the "Very Good" category. In the display aspect of the application, the total score of the answers to all the questions was 567 out of 640 with a maximum score and a percentage of 88.59% in the "Very Good" category. In the hologram video aspect, the total score for all answers to all items is 430 out of 480 maximum scores and a percentage of 89.58% in the "Very Good" category. In the aspect of benefits, the total score for all answers to all items is 581 of 640 maximum scores and a percentage of 90.78% in the "Very Good" category.

Based on the overall summary of the results of the large group trials, the media received a positive response with a total score of 2165 out of 2400 maximum scores and a percentage of 90.20% in the "Very Good" category. So that it can be said that the developed media provides useful value and convenience for users, in other words, hologram-based media is practical to use.

Hologram-based learning media can be declared effective, this is reviewed based on student learning outcomes. Based on the results of research conducted by researchers, it was found that the hologram-based learning media used can have a very good effect on students. At the time of giving the pretest before using hologram-based learning media with a total of 10 numbers of questions, of 32 students the highest score was 80, while the lowest score was 20. The average student score was at 50.62% with the number of students who completed 2 participants students and then students' classical completeness at 6.25%.

Then after the hologram-based learning media was used, the results of the study stated that of the 32 students the highest score was 90, the lowest score was 40, the average student score in the posttest was 75.31% with the number of students who completed 25 students, as well as classical completeness students on the posttest 78.12%.

Based on the description above, it can be stated that the mean value and classical completeness posttest are higher than the average value and classical completeness pretest. It can be concluded that the developed hologram-based learning media is effective.

CONCLUSION

Based on the results of the research and discussion that has been carried out, it can be concluded that:

1. The feasibility of hologram-based learning media is based on the assessment of media experts with a total percentage of 95.62% in the very feasible category and the assessment of material experts with a total percentage of 97.14% in the

very feasible category. Thus, this hologram-based learning media fulfills the very feasible category to be used as a learning medium.

2. The response of class VII students of SMP Negeri 53 Makassar as users of learning media based on the results of the small group trials with a percentage of 94.44% in the very good category and the results of the large group trials with a total percentage of 90.2% in the very good category so that the media is suitable for use as learning media in the learning process.

3. The developed hologram-based learning media meets effective and practical aspects. It is known based on the mean scores and classical completeness posttest higher than the average scores and classical completeness pretest. So that the developed hologram-based learning media is effective. Meanwhile, based on small group trials, the media received a positive response with an overall score of 425 out of 450 maximum scores and a percentage of 94.44% in the "Very Good" category. And in the large group test, the media received a positive response with a total score of 2165 out of 2400 maximum score and a percentage of 90.20% in the "Very Good" category. So that it can be said that the developed media provides useful value and convenience for users, in other words, hologram-based media is practical to use.

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